

The University of Chicago

THE BLANCO FAUNA

A DISSERTATION SUBMITTED TO THE FACULTY
OF THE DIVISION OF THE PHYSICAL SCIENCES
IN CANDIDACY FOR THE DEGREE OF DOCTOR
OF PHILOSOPHY

DEPARTMENT OF GEOLOGY
JUNE, 1946

By
GRAYSON E. MEADE

Reprinted from
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INTRODUCTION

The present paper describes several collections of vertebrate fossils from the Blanco beds of Crosby County, Texas. The principal collection is one made during the spring and summer of 1941, when the Bureau of Economic Geology, through the State-wide Paleontologic-Mineralogic Survey, made collections of fossil vertebrates from the Blanco beds for the purpose of obtaining additional information on the paleontology and geology of this classic locality. The material was collected by Work Projects No. 15995, under the supervision of Mr. Richmond Bronaugh. The specimens were prepared by Work Projects Administration Official Project No. 665-66-3-233. A few Blanco specimens in the collection of the West Texas Museum at Lubbock are included, as well as some additional material collected by Glen L. Evans, Carl Chelf, and the writer in the summer of 1943. During the progress of all the field work, particular attention was paid to the stratigraphic occurrence of the fossils. At each of the major fossil sites a section was measured from the bottom to the top of the Blanco beds in order that the exact horizons in which the fossils occurred could be determined.

Nearly all the known members of the Blanco fauna are included in these collections. Several genera, namely, *Procas-toroides*, *Hypolagus*, *Panthera*, *Camelops*, *Gigantocamelus*, *Tanupolama*, and *Capromeryx*, described in this paper have not been reported previously from the Blanco. A comparison of this fauna with the upper Pliocene and lower Pleistocene faunas of North America indicates a lowermost Pleistocene age for the Blanco fauna.

The writer wishes to express particular gratitude to Dr. E. H. Sellards for the privilege of studying the collection of Blanco fossils, for assistance in carrying on this work at the Bureau of Economic Geology, and for permission to transport many of the fossils to Lubbock for study.

Sincere thanks are due Dr. Everett C. Olson for critically reading the manuscript and for offering many valuable suggestions. The writer is indebted to Mr. Glen L. Evans for valuable discussions and many important suggestions. Dr. Paul O. McGrew has aided with many helpful suggestions and by reading of the manuscript. The department of zoology of the Chicago Natural History Museum has helped by generously allowing their collection of recent felid material to be studied. Appreciation is expressed to Mr. J. S. Bridwell and to Mr. R. B. Smith for their coöperation and for permission to collect the fossils on their respective ranches.

DESCRIPTION OF LOCALITY

The Blanco beds lie near the eastern edge of the Llano Estacado in Crosby County, Texas (fig. 1). The principal exposures occur on the canyon slopes of Crawfish Draw about 2 miles west and north of its confluence with White River, on the J. S. Bridwell and R. B. Smith ranches 10 miles north of Crosbyton, Texas (see fig. 2). Most of the fossils were found in the exposures on the north side of Crawfish Draw, west of the Crosbyton-Floydada road, and south of Mount Blanco. Six miles northeast of Crosbyton, on both sides of the public road, is another more limited exposure of the Blanco beds where a few fossils were collected. Between these two localities, on the east side of White River and east of Mount Blanco, is an exposure of Blanco beds traversed by the Cone-Mount Blanco road.

Matthew (1924b) calls attention to an exposure of supposed Blanco beds $2\frac{1}{2}$ miles southeast of Crosbyton in a small tributary on the west side of Blanco Canyon. He reports that no fossils were found at this locality. In 1942, Glen L. Evans and the writer visited this locality and searched for fossils but failed to find any. Matthew also mentions a smaller outcrop of beds similar in lithology to the Blanco about 20 miles south of Crosbyton near where the main road to Post comes down off the plains. He reported that no

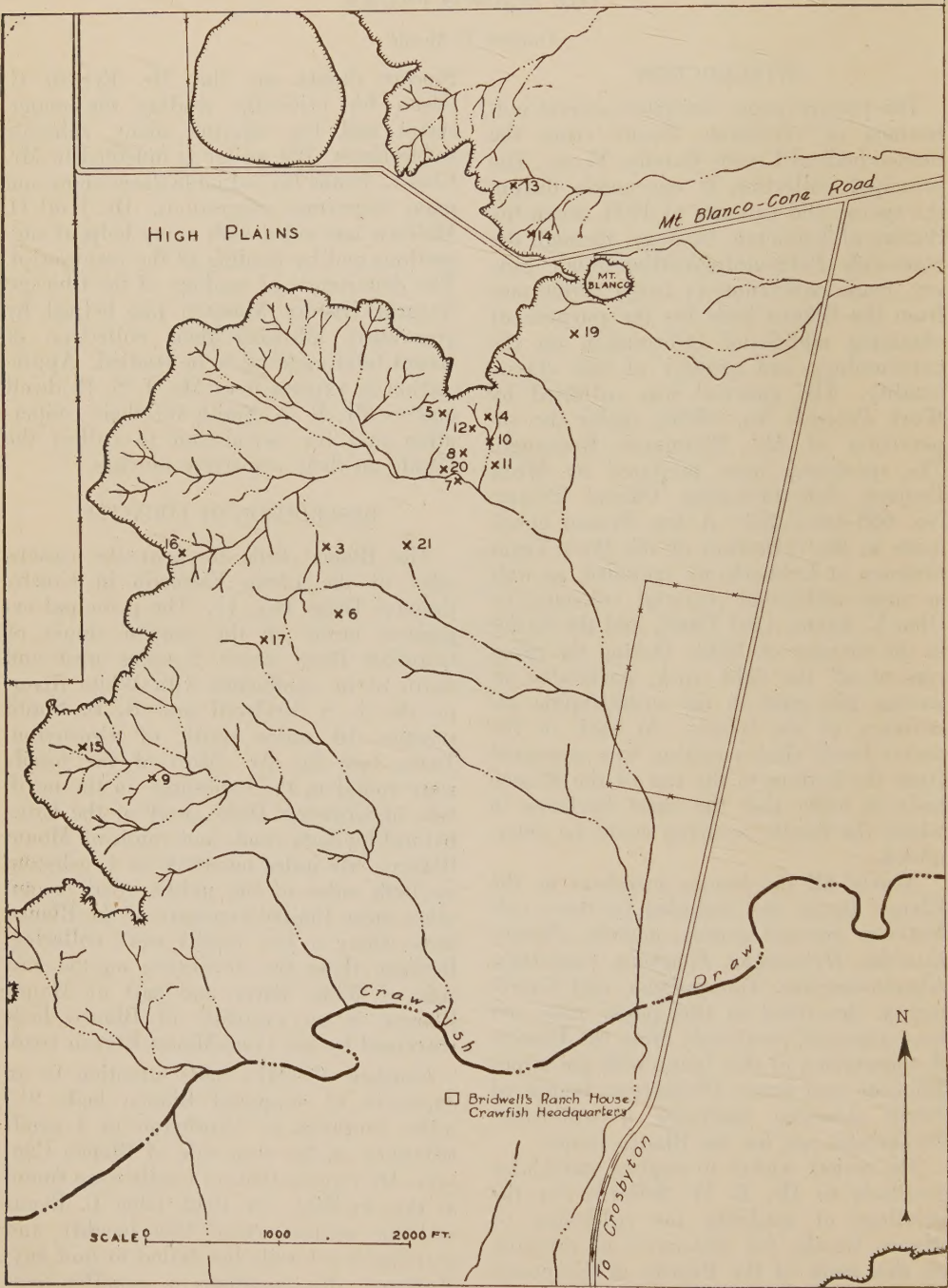


Fig. 1. Map showing location of the major collecting sites in the Blanco beds, Crosby County, Texas.

fossils were found here either. This area also was examined by Evans and the writer, who failed to find any exposures that could definitely be correlated with the Blanco.



Fig. 2. Exposure in the Blanco beds on the J. S. Bridwell ranch, Crosby County, Texas. Basal contact is beneath gray sandstone seen in bottom of picture. Photograph by Glen L. Evans, June, 1941.

PREVIOUS WORK IN THE BLANCO BEDS

In the winter of 1889-90, Mr. W. F. Cummins discovered the first vertebrate fossils from the Blanco beds. Cummins wrote (1890, p. 190) that: "Overlying and resting unconformably upon the Dockum Beds are beds of red clay, white sandy clays, white clays, and a hardened clayey limestone, fronting to the eastward and forming bold escarpments 200 feet high. These beds constitute the staked plains. Because of the extensive presentation of these strata in Blanco Canyon,

Dickens County, I have given them the name of Blanco Canyon beds." The only fossils that he found in these beds "were some of the larger mammals and a species of turtle." He did not have sufficient data to enable him to place the Blanco Canyon beds in their proper geologic position but indicated that they were of "—much more recent date than Cretaceous—."

It is apparent from the description of the beds that Cummins was applying the name Blanco Canyon Beds to all the post-Cretaceous deposits of the Staked Plains.

In 1891 Cummins further discussed the Blanco Canyon Beds and included a section made about 1 mile south of Mount Blanco. In 1892 he changed the name of the Blanco Canyon Beds to Blanco Beds, because the double name was undesirable and because the beds were also found far from Blanco Canyon.

By this time he had traveled entirely around the Staked Plains and believed that over nearly all the Staked Plains area the upper strata belonged to the Blanco beds. To explain the origin of these widespread deposits he assumed a great inland "sea" covering approximately the area of the present Staked Plains. The lower part of the Blanco was thought to thicken to the northwest and the upper limestone bed¹ was found to be of about the same thickness wherever observed. Thus a lacustrine origin was assumed for the Blanco beds.

The first attempt to place the Blanco beds definitely in their proper geologic position was made by Cummins. He believed them to be equivalent to the White River beds.²

Some of the fossils which Cummins had collected were sent to Cope for identification. On the basis of these fossils Cope believed the Blanco beds to be intermediate between Loup Fork and the *Equus* beds. Later in the year Cope accompanied Cummins in a more thorough exploration of the Staked Plains, and additional fossils were collected from the Blanco beds.

The following year (1893) Cummins further discussed the Blanco beds: "This

¹The omnipresent caliche zone of the Staked Plains and many other territories in the Southwest.

²Reported by Cummins (1891) to be equivalent to the Green River beds but meaning the White River beds; a mistake which he rectified the following year (1892).

formation constitutes the eastern scarp of the Staked Plains from the Double Mountain Fork of the Brazos on the south to Paloduro Canyon on the north." He also considered some exposures near Miami in Roberts County, Texas, as a part of the Blanco beds.

The American Museum sent an expedition, under the leadership of Dr. Gidley, to the Staked Plains for three consecutive summers from 1899 to 1901. The party did not reach the Mount Blanco area the first season, but in the following two seasons made large collections from the Blanco which added materially to the knowledge of its fauna.

Gidley (1903b) concluded that the Blanco beds were true Pliocene but of limited extent, occurring in the vicinity of Mount Blanco, and traceable for 15 to 20 miles eastward to the edge of the plains. He showed that Cummins's interpretation of the Blanco beds in Roberts County was based upon the erroneous identification of some horse teeth. It also became evident to him that in the vicinity of Mount Blanco, the bottom 32 feet of Cummins's section included beds of reddish clay and red clay which were older than the Blanco.

He disagreed with Cummins's interpretation of the origin of the Blanco sediments, believing them to be fluvial and not lacustrine. Gidley (1903b, p. 625) states: "It is thus seen that the Blanco beds, at Mount Blanco, like the Rock Creek beds, apparently occupy a comparatively narrow valley or basin formed for their deposition by ancient erosion of the older beds. Like the Rock Creek beds also they extend a long distance in one direction, being traceable south-eastward for fifteen or twenty miles to the edge of the Plains. Though the deposits differ in character from those of the Rock Creek beds and the fauna indicates an earlier age, here, as at Tule Canyon, there is a total absence of any proof of a lake origin for these beds and many evidences of river or stream deposition.

"The occasional beds of diatomaceous earth are easily accounted for by supposing that there were in this ancient valley occasional ponds filled with clear water, enduring for various periods of time, partially or totally isolated from the stream that ran through the valley, such as exist

at the present time in the West, especially in the Sand-hills country of northwestern Nebraska and southern South Dakota."

Baker (1915) briefly discussed the Blanco beds with respect to their origin. He believed them to be probably a stream deposit and to occupy a comparatively narrow valley or basin formed for their deposition by erosion of the older beds.

In 1924, Matthew and Simpson collected vertebrate fossils from the Blanco beds. Matthew prepared a report on the fauna and geology of the Panhandle area of Texas; a part of this report was devoted to his observations on the Blanco. Matthew also showed that the Blanco beds were of limited extent and mentioned four separate localities. These are essentially the same as the localities now known to exist, which have already been mentioned in "Description of Locality." Matthew, however, considered these localities to be only the fossiliferous portion of the Blanco. He believed the upper portion of the Blanco to be interdigitated with and contemporaneous with the upper part of the Panhandle clays. Thus he assumed a wider distribution for the Blanco than Gidley had previously shown.

Matthew also believed the Blanco to be fluvial in origin. "We believe all of these to be stream-valley fillings,"—"The Blanco beds were deposited in a broad and shallow slowly aggrading stream valley with a slow-flowing, probably intermittent stream of about the type of the present Blanco Creek. The valley would be partly occupied then as now by abandoned stream channels forming ponds and muckholes—."

This interpretation of a fluvial origin for the Blanco has generally been accepted without question by subsequent workers. Evans and Meade (1945), however, have shown that this interpretation is untenable, and that the deposits were laid down in a basin rather than in a stream bed.

THE BLANCO STAGE

Osborn (1936, p. 675) thought that the "Blanco formation" included more than one specific stage and that it probably represented a long period of geologic time. This assumption apparently was based principally upon the advanced

Stegomastodon texanus, from the upper levels of the Blanco, compared with the more primitive *S. successor* from the lower levels of the Blanco.

Faunal assemblages here regarded as Blancan in age include the Blanco, Hagerman, Coso Mountains, Benson, Sand Draw, Broadwater, Cita Canyon, and Rexroad. It becomes a matter of some importance then whether the Blanco represents one or more than one specific stage. If more than one stage is represented in the Blanco, it is probable that other Blancan assemblages also represent more than one specific stage.

The number of stages represented by the Blanco of Texas may be determined by both the paleontologic and the geologic evidence. The paleontological evidence is discussed later under "Unity of Fauna." To examine the geologic evidence, it is necessary to return to the mode of origin of these deposits.

Evans and Meade (1945) have demonstrated that the Blanco deposits occupy basins or depressions within the Tertiary beds. At some time subsequent to the formation of the basins they began to be filled with lacustrine deposits. There is no indication that this cycle of basin filling was interrupted at any time from its beginning until the basin was essentially filled, because there are no unconformities which can be traced for any distance across the basin. Minor breaks in sedimentation are in evidence in the entire section, but these appear to indicate fluctuations in the water level and temporary rejuvenations of the influent drainages. The alternating sands and clays, however, may represent relative changes in the rate of accumulation of the deposits. Many of the clays are bentonitic, probably representing an alteration of volcanic ash which fell into the basin. This would indicate a fairly rapid accumulation of individual clay beds. The almost pure diatomite and the limestone layers indicate periods of considerable duration when there was permanent water beyond the point to which clastic sediments from the shores were carried.

The old "Blanco Basin" then contained permanent water part of the time, and probably for periods of considerable duration. It served as a watering place for the

animals from its origin until the basin was filled with sediments, or until it was dissected and drained by the headward erosion of White River. Its geologic history probably is included within one major climatic cycle.³ Minor climatic cycles either left no imprint, or they may be recorded by the local unconformities which are present. If the assumption is correct that Blanco time is included in a single major climatic cycle, then the fauna preserved in these deposits also represents a specific stage, and not several stages.

MANNER OF ACCUMULATION OF FOSSILS

The lacustrine origin of the Blanco sediments does not materially alter the previous conceptions of the environmental conditions and the accumulation of the fossils in a "stream-valley filling." Matthew (1924b) said of the Blanco that: "We believe all of these to be stream-valley fillings, accumulated not after the Panhandle clays were deposited and eroded, but simultaneously with the upper part of the Panhandle. The latter we regard as plains deposits, perhaps partly accumulated by occasional wide flooding from the streams, but chiefly due to the slow but steady accumulation of dust on a sodded prairie surface with imperfect drainage and scattered playa lakes—in fact just such a surface as exists at the present time, only with the streams little below the general level instead of being in deep canyons. The utter barrenness of the Panhandle clays is due to the very slow accumulation, so slow that skeletons and bones were completely disintegrated and destroyed by weathering before they were buried deep enough for preservation. The Blanco beds were deposited in a broad and shallow slowly aggrading stream valley with a slow-flowing, probably intermittent stream of about the type of the present Blanco creek. The valley would be partly occupied then as now by abandoned stream channels forming ponds and muckholes in which animals would be most frequently caught and buried whole, the stream channel beds proper,

³A major climatic cycle as used here denotes a predominately humid or arid climate of considerable duration. During Blanco time the climate was relatively humid, for only under such conditions could permanent or nearly permanent lakes have been maintained.

mostly sandy, being likely to have any remains of animals pretty well broken up and disarticulated before they were permanently buried. The several articulated skeletons that have been found in the Blanco, were preserved in white clays; the fragmentary material is chiefly from sandy clays and sands."

The inferred presence of ponds and muckholes would offer essentially the same conditions for the entrapment and preservation of animals as would a shallow lake. The sands, however, do not represent stream channel beds, and the fact that most of the Blanco fossils were disarticulated and many broken before permanent burial cannot be explained as a result of stream action.

The present occurrence of fossils in the Blanco beds is mostly confined to the marginal areas of the basin. It is not known whether or not the central part of the basin contained fossils, as that part has been removed by erosion. However, in similar basin deposits on the west Texas plains, nearly all of the fossils occur in the marginal areas. In those basin deposits where the central part is present and exposed by erosion, few if any fossils are to be found. It may be assumed that the animals did not venture out into the deeper water in the central part of the basin; that they were caught, or died, and were buried in the marginal areas. Here the bones would be subject to some transportation by wave action of the water, and by intermittent streams which entered the basin.

The predatory animals must also assume their share of responsibility for the destruction and dispersal of many of the bones. Many of the smaller animals may have been completely devoured, which perhaps partially explains the paucity of such forms in the Blanco. However, it is far more likely that the rarity of small forms is the result of careless collecting. A few small forms are present in the Blanco and more are sure to be found. Certainly the sedimentary conditions that prevailed during much of Blancan time must have been nearly at an optimum for the preservation of the large and small animals alike.

The depredations of the carnivores must be assumed to have taken place either in the shallow water of the lake margins or

on the shore bordering the lake. In feeding upon the herbivores they would necessarily have scattered the bones over a probable distance of several yards. Bones left lying close to the water's edge may have been subsequently washed into the lake by intermittent streams which entered the basin.

An illustration of the concentration of disarticulated bones which may have accumulated in such a manner is shown by the camel bones in Site No. 11. Here the deposit of *Gigantocamelus* remains (fig. 3) may represent a herd of camels which ventured into the shallow waters of the ancient lake and were trapped or were overcome by carnivores at the edge of the water. In one small area were found the partial and complete skulls and jaws of about eighteen individuals. An abundance



Fig. 3. *Gigantocamelus* bones at Site No. 11, Crosby County, Texas. The fossils are near the bottom of the basal sand of the Blanco beds. Photograph by Glen L. Evans.

of limbs, vertebrae, ribs, and the like were found also, but there were practically no articulated bones.

The bones would also be subjected to trampling and a certain amount of scattering by the larger animals wading in the marginal parts of the lake in search of vegetation growing in the shallow water. That the camels, horses, peccaries, and probably the mastodons did just that may be illustrated by the action of modern horses and cattle which wade considerable distances out into the ponds and lakes to obtain vegetation or to escape flies and other insects. On numerous occasions horses and cattle have been seen far out in shallow ponds and lakes feeding upon the vegetation, and on one occasion a pig was seen enjoying an early morning swim, fully a hundred yards from the shore, and in water over 3 feet deep.

The field party of the Bureau of Economic Geology did not find any articulated skeletons but did find several articulated camel skulls and jaws and a number of articulated leg bones. The articulated horse skeletons found by Matthew were preserved in white clays. Presumably these represent individuals that were buried sufficiently far out in the basin to escape those processes which would have tended to scatter the bones. Even in the marginal deposits one cannot imagine that at least some individuals were not buried in their entirety. But the fact that most of the fossils are disarticulated, and many are broken, would indicate that most of the animals which were caught in the lake had been subjected to trampling by their contemporaries, or their bones had been scattered by carnivores, by wave action, or by intermittent waters entering the lake.

FAUNA

BLANCO FAUNAL LIST

Cope (1893), Gidley (1903), and Matthew (1924) have recorded the fauna of the Blanco. The following is a revised faunal list of the Blanco beds.

Reptilia

Testudo turgida Cope
Testudo pertenuis Cope
Testudo campester Hay

Aves

Creccoides osbornii Shufeldt

Mammalia

Procastoroides sp.
Hypolagus sp.
Canimartes cumminsii Cope
Borophagus diversidens Cope
Panthera palaeonca, n. sp.
Stegomastodon successor Cope
Rhynchotherium falconeri Osborn
Serbelodon (?) *praeursor* Cope
Megalonyx leptostomus Cope
Glyptotherium texanum Osborn
Hippotigris simplicidens (Cope)
Nannippus phlegon (Cope)
Platygonus bicalcaratus Cope
Platygonus texanus Gidley
Camelops cf. *kansasus* Leidy
Gigantocamelus spatula (Cope)
Tanupolama blancoensis, n. sp.
Leptotylopus percelsus Matthew
Capromeryx sp.

UNITY OF THE FAUNA

Osborn (1936) believed that the Blanco included more than one specific stage and that it represented a long period of time. The evidence does not substantiate this view. On the contrary, it indicates that the Blanco represents but a single age. The geologic evidence has already been cited. The fauna shows no evidence of more than one age, nor does it indicate any great lapse of time from the beginning of Blanco deposition to the end. There is no discernible difference among individuals of the same species which occur in the lower levels as compared with those that occur in the higher levels of the Blanco deposits. In the mammalian group, with the possible exception of *Stegomastodon*, *Platygonus* is the only genus at present represented by more than one species. Here it might be expected that one species would be confined to the lower levels and one species confined to the upper levels, particularly if a considerable lapse of time is allotted to the Blanco. If such were the case it would be indicative that the one species had been descended from the other. However, such is not the case, and the two species of *Platygonus* occur together in the lower and in the upper levels. Similarly, there is no vertical zonation of the stegomastodons; both the "advanced" and "primitive" forms occur together from the lower to the uppermost fossiliferous horizons.

Stirton and VanderHoof (1933) suggested the possibility that "*Plesippus cumminsii*" came from the beds underlying the Blanco. This possibility is unlikely

as "*P. cummingsi*" is probably a synonym of "*P. simplicidens*" which is a characteristic Blancan form. Evans and the writer have carefully searched these underlying beds and have found a number of fossils, all indicative of middle Pliocene age, including the genera *Neohipparion* and *Astrohippus*. None of the forms from the underlying beds occur in the Blanco, nor do any known Blancan forms occur in the underlying beds. Inasmuch as the Blanco deposits consist in part of sediments reworked from the Pliocene beds, it is possible that reworked Pliocene fossils have been introduced. This possibility, however, is remote because of the preservation and comparative paucity of fossils in the adjacent Pliocene beds.

CORRELATION OF FAUNAL ELEMENTS

In the correlation of mammalian faunas the entire faunal assemblage should be considered. In any given assemblage, there are certain genera which are more useful in correlations than others because of their shorter geologic range, greater geographic distribution, more rapid evolution, or greater abundance as fossils. Before a fauna can be considered as a whole, however, each representative of that fauna should be viewed with respect to its relative diagnostic importance to the entire fauna. Thus the correlation of the Blanco fauna is preceded by a correlation of its faunal elements in which are discussed the principal occurrences and the geologic range of the Blanco genera. This information on each genus provides a basis for the correlation of the Blanco fauna.

Procastoroides is known from the Broadwater, Rexroad, Sand Draw, and the Blanco. This genus is a typical member of the Blancan faunas, and so far as is now known its range is limited to the Blancan age.

Hypolagus ranged from the middle Miocene to the Blancan. The single tooth of this genus from the Blanco is specifically indeterminable. In view of the extensive range of the genus, the specimen is not diagnostic in correlations.

Canimartes is not well enough known to be of value in the present correlation.

Borophagus occurs in the Coso Mountains fauna, as well as in the Tehama,

Hagerman, and the Blanco. It is one of the genera limited to the Blancan of North America.

Panthera is the only felid material represented in the Blanco. The geologic range and the relationships of late Pliocene and Pleistocene felids, however, are too inadequately known to permit accurate correlations based on this group.

Proboscideans are well represented in the Blanco. *Stegomastodon* is a characteristic Pleistocene genus. It is the most common proboscidean in the Blanco. Osborn (1936) considers *S. primitivus* from the first interglacial as more primitive than *S. successor* from the Blanco, and the type of *S. mirificus* from the second glacial as more primitive than *S. texanus* from the Blanco. Lugin and Schultz (1934) determined the horizon of the "*Stegomastodon primitivus* quarry" as probably Aftonian, or the first interglacial stage. They determined the horizon of *S. mirificus* to be Kansan or second glacial stage. With respect to these proboscideans Osborn (1936) said: "Inasmuch as three types of *Stegomastodon*, namely, *S. successor*, *S. texanus*, and *S. arizonae*, definitely belong in the Upper to Uppermost Pliocene, it is obvious that the geologic age of both *S. primitivus* and of *S. mirificus* demands further investigation."

The demands for "further investigation" have resulted in: (1) The definite assignment of the Curtis, the locality of the type of *S. arizonae*, to the lower Pleistocene; (2) the retention of an Aftonian age assignment for the *S. primitivus* quarry; and (3) the correlation of the *Stegomastodon* quarry with the Sand Draw by McGrew.

If *Stegomastodon primitivus* and *S. mirificus* are more primitive than the Blanco species as Osborn believed, there remains little reason for continuing to consider the latter as upper Pliocene mastodons. The writer can see no logical alternative to the view that the Blanco stegomastodons are true Pleistocene forms.

Rhynchotherium and *Serbelodon* are characteristic Pliocene genera. Their presence along with the characteristic Pleistocene genera of the Blanco indicates that they are survivors from an earlier period. The latter genus carries no weight in the

problem since the generic reference is doubtful. Osborn considered *Rhynchotherium falconeri*, from the Blanco, as the most advanced species of the genus, and one can readily admit of the probability that this species lived into the early Pleistocene. McGrew (1944) has suggested that certain primitive proboscideans did not range as far northward as Broadwater or Sand Draw. This supposition is given support by the presence of *Rhynchotherium* in the Blanco and its absence in more northerly deposits of equivalent age. *R. francisi* is of doubtful geologic occurrence as well as of questionable generic reference. The specimen comes from Brazos River, Burleson County, Texas. The county is in a region of Eocene rocks, not late Tertiary. Inasmuch as the specimen comes from Brazos River, it is probable that it is from a Pleistocene alluvial terrace and not from the Pliocene. If this is correct, and the tooth is correctly referred to *Rhynchotherium*, it offers additional evidence of the range of this genus into the Pleistocene.

The absence of mammoths in the Blanco might be argued as evidence against its Pleistocene age if the first appearance of mammoths coincides with the beginning of the Pleistocene in North America. Their absence in the Broadwater and the Sand Draw and other faunas thought to be of lower Pleistocene age is fairly conclusive evidence that the mammoths did not reach North America until some time after the beginning of the Pleistocene.

Megalonyx leptostomus is the only species of sloth known from the Blanco. The genus is reported from other Blancan deposits. It probably makes its first appearance in this country in the middle Pliocene. Its geologic range extends into the Pleistocene. The sloth material from the Blanco appears to be inconclusive, at present, in correlations and age determination of the beds.

Glyptotherium texanum represents the only Pliocene occurrence of this group of edentates, if the Blanco is considered to be of Pliocene age. Glyptodonts are typical members of the Pleistocene faunas. The evidence may be inconclusive, but the

presence of glyptodonts is decidedly more suggestive of a Pleistocene than of a Pliocene age.

Hippotigris is limited to the North American Blancan.

Nannippus phlegon apparently represents the last and most progressive species of the genus. The genus is a survivor from earlier periods and lived longer in the South than in the far West or North (McGrew, 1944.) This species is limited to the North American Blancan.

Platygonus is another characteristic Pleistocene genus with a wide geographic range. Gazin (1938) pointed out that the only material definitely referable to the genus *Platygonus* occurring in pre-Pleistocene deposits was that from the Coso Mountains, Benson, Hagerman, and the Blanco. If, as is compatible with the evidence, these faunas are considered to be of lower Pleistocene age, then there remains no valid occurrence of the genus in the Pliocene.

Gigantocamelus is known to occur in only four localities: the Broadwater and Sand Draw quarries of Nebraska, the Blanco, and the Rita Blanca deposits in Hartley County, Texas. The genus is most certainly characteristic of the Blancan and, so far as known, is confined to this age.

Tanupolama occurs in the McKittrick and Rancho La Brea tar pits and in the Pleistocene deposits of Florida, Hay Springs, Broadwater, Coso Mountains, and Blanco. Gidley (1922) reported a *Lama* from the Curtis of San Pedro Valley, which in all probability is *Tanupolama*. The genus is one of the most characteristic Pleistocene forms, and there are no valid occurrences in pre-Blancan deposits.

Leptotylopus is known only from the Blanco.

Capromeryx is a characteristic Pleistocene genus. It doubtfully occurs in the Pliocene.

CORRELATION OF THE BLANCO FAUNA

The Blanco fauna may be correlated with the Broadwater, Rexroad, Hagerman, San Joaquin, Benson, Coso Mountains, Sand Draw, Tehama, and Cita Canyon.

The age of the Blanco beds was not determined by Cummins except that in 1890 he stated that they were much more recent than the Cretaceous, and in 1892 that they were the equivalent of the White River. Cope (1892a) believed the deposits to be intermediate between the *Equus* beds and the Loup Fork. Gidley (1903b) considered the age to be middle Pliocene and Matthew (1924b) also thought the Blanco to be of middle Pliocene age. More recently the age has been generally accepted as upper Pliocene. Gazin (1936) observed that the upper Pliocene Hagerman horizon was not far removed from the Blanco and that the differences between the two faunas might be only of geographic significance.

J. R. Schultz (1938) correlated the Blanco with the San Timoteo, Hagerman, Coso Mountains, and Tehama. He had sufficient faunal evidence to indicate that many of the Blancan faunas were more recent than upper Pliocene and considered them as transitional from upper Pliocene to Pleistocene.

Johnston (1938) called attention to the close relationship between the Cita Canyon fauna and that of the Blanco.

Hibbard (1938) considered the Rexroad to have its closest relationships with the Blanco and that it was as old as or older than the Blanco. Later, in 1941, he stated that the Rexroad, Blanco, Benson, and Hagerman faunas were of approximately the same age.

McGrew (1944) regarded the Sand Draw quarry as Pleistocene in age on the basis of geological, invertebrate, and vertebrate evidence and presented adequate reasons for considering the Blancan as lower Pleistocene.

There has never been any conclusive evidence that the Blanco fauna was of Pliocene age. Previous to the discovery of several new genera, which are discussed in the present paper, there likewise has been no conclusive evidence to show that the Blanco was younger than Pliocene.

The Blanco fauna is characterized by certain short range genera such as *Procastoroides*, *Borophagus*, *Gigantocamelus*, and *Hippotigris*, which are known only in the Blancan; by *Nannippus* and *Rhynchotherium*, typical Pliocene genera which are unknown in post-Blancan deposits;

and by several long-range genera including *Camelops*, *Tanupolama*, *Capromeryx*, and *Platygonus*, which appear first in the Blanco and which survive through most or all of the remaining Pleistocene. The fauna as a whole is obviously much more closely allied to the Pleistocene faunas than to any known Pliocene fauna. There can be no disagreement on the advisability of dating a fauna on the basis of its most recent elements, rather than on the basis of those which may have survived from an earlier age. If this is done, the evidence is in favor of an early Pleistocene rather than a Pliocene age for the Blanco. The writer believes that the combined weight of the newly discovered forms in the Blanco and the evidence presented by J. R. Schultz and by McGrew is sufficient proof that the Blancan is of Pleistocene and not upper Pliocene age.

McGrew has indicated a time gap between Hemphillian and Blancan ages. There are many indications in this region that such a time gap does exist. There is a considerable faunal break between the middle Pliocene Hemphill and the Blanco, and as yet there are no known faunas that fill this hiatus. Middle Pliocene is the latest definitely known Pliocene to occur in west Texas, and nearly everywhere the upper part of these beds is characterized by a development of caliche, which varies from a few feet up to 30 feet in thickness. This represents a prolonged period of aridity, relatively dryer than the present climate, and a time when there were exceptionally few, if any, deposits accumulating in this area. It is not possible at present to determine how great a time span this caliche development may represent. But it is significant that the deposition of the Blanco sediments did not commence until after the formation of some of the caliche. Climatic changes were responsible for the cessation of caliche development and the initiation of a new cycle of sedimentation. The climatic changes that occurred at the beginning of the Pleistocene may correlate with the changed climatic conditions in this area. With one or two exceptions, all the known basin deposits on the plains are of Blanco age or younger. It seems probable that the alternating climatic conditions of the Pleistocene were favorable for the forma-

tion and the filling of basins, since dozens of Pleistocene basin deposits are known.

On geologic evidence alone, the age of the Blanco would be difficult if not impossible to determine. The Blanco beds lie upon the middle Pliocene and are overlain by wind blown sands of Pleistocene age. The following geologic facts, however, are significant: The Blanco beds were deposited during a relatively humid stage of considerable duration, under conditions totally unlike those of the upper Pliocene. The Blanco beds were deposited during a glacial stage rather than during a relatively arid interglacial stage. The Blanco stage probably was of greater duration than the middle Pleistocene Tule, or the late Pleistocene Tahoka, because of the greater thickness of lacustrine deposits in the Blanco and because the Blanco basin was more completely filled than were the known middle and late Pleistocene basins. Thus the geological evidence is indicative of an early Pleistocene age for the Blanco. The paleontological evidence indicates an early or earliest Pleistocene age. Accordingly the Blanco is considered to be of Nebraskan age.⁴

⁴The Sand Draw, an equivalent of the Blanco, was considered by McGrew (1944) to be of Aftonian age. His Aftonian (as opposed to Nebraskan) assignment was based upon invertebrate and geological considerations and not on the mammalian fauna. The term Blancan, then, should no longer be used as a provincial age for the upper Pliocene, but for the lower Pleistocene, Nebraskan. ~~Probably~~ The Blancan should include both the Nebraskan and Aftonian faunas. The upper limit of the Blancan may provisionally be placed at the top of the Aftonian, inasmuch as it is doubtful whether Nebraskan and Aftonian faunas can be differentiated. Post-Aftonian faunas are far too distinctive ever to be included in the Blancan.

Fossil Sites in the Blanco Beds

The positions of the fossil sites worked by the field party of the Bureau of Economic Geology are plotted on figure 1. Sites No. 1 and 2 did not yield any identifiable fossils; consequently they are not listed in the following tabulation. Sites No. 13 and 14 are on the R. B. Smith ranch on the slopes of the first reëntrant on the north side of the Cone-Mt. Blanco road and east of a large pond on the surface of the plains and near the escarpment. All the other sites are on lands owned by J. S. Bridwell and lie between Mt. Blanco and the mouth of Crawfish Draw on the west side of White River, with the exception of Site No. 22 which is on the east side of White River and several miles southeast of the other sites.

DESCRIPTION OF FAUNA

Class REPTILIA

Order TESTUDINATA

Family TESTUDINIDAE

TESTUDO sp.

Referred specimens.—Several individuals with nearly complete carapace and plastron, and numerous individual fragments.

Discussion.—Much of the turtle material has not been prepared. The specimens are undoubtedly referable to the known Blanco species, but specific identification has not been made.

Site No.	Locality and Horizon	Principal Genera
3	East side of Crawfish Draw, 19 feet above basal contact with red Tertiary clay.....	Nannippus Hippotigris
4	350 yds. S. 75 yds. E. of gate near Mt. Blanco, 35 feet above basal contact.....	Platygonus bicalcaratus Platygonus texanus Megalonyx Stegomastodon
5	350 yds. S. 20° E. of gate near Mt. Blanco, 35 feet above basal contact	Stegomastodon
6	Approximately 875 yds. due north of Crawfish ranch house, on S. side of canyon, underlying diatomite bed, 28 feet above basal contact	Hippotigris Platygonus bicalcaratus Platygonus texanus Procastoroides Tanupolama Capromeryx
7	On north side of steep bluff capped by reefy limestone, 75 yds. SW. of Site No. 8, at basal contact.....	Rhynchotherium

Site No.	Locality and Horizon	Principal Genera
8	60 yds. W. of Site No. 11, 35 feet above basal contact.....	Platygonus bicalcaratus Platygonus texanus Stegomastodon Camelops
9	650 yds. NW. of Crawfish ranch house, on S. side of draw, 17 feet above basal contact, in gray sand lens immediately above "flaggy limestone" member.....	Platygonus bicalcaratus Hippotigris Borophagus Leptotylopus
10	35 yds. S. of Site No. 4, mostly at basal contact.....	Gigantocamelus
11	60 yds. E. of Site No. 8, on S. point of ridge, mostly at basal contact.....	Gigantocamelus Camelops Tanupolama Panthera
12	25 yds. W. of Site No. 10, 35 feet above basal contact.....	Stegomastodon
13	150 yds. NW. of Mt. Blanco, on S. side of small draw on the R. B. Smith ranch, 38 feet above basal contact.....	Platygonus bicalcaratus Platygonus texanus Glyptotherium
14	100 yds. NW. of Mt. Blanco, within 30 feet of the Cone-Mt. Blanco road, 38 feet above basal contact.....	Glyptotherium Stegomastodon
15	50 yds. W. of Site No. 9, NW. of Crawfish ranch house, on N. side of draw, in same horizon as Site No. 9.....	Stegomastodon Hippotigris
16	25 yds. NW. of Site No. 17, on W. side of draw, 50 feet above basal contact.....	Stegomastodon Megalonyx Hippotigris
17	50 yds. W. of Site No. 6, S. side of canyon wall, in upper part of basal massive sand.....	Platygonus texanus
18	120 yds. S. 10° W. of Site No. 21, on S. side of draw, in basal sand at lower contact.....	Stegomastodon
19	100 yds. SW. of Mt. Blanco, on the S. side of the draw, at basal contact.....	Stegomastodon Camelops
20	35 yds. N. 20° W. of Site No. 7, on N. side of draw, 12 feet above basal contact.....	Hippotigris Testudo
21	200 yds. S. 30° W. of Site No. 7, 43 feet above basal contact.....	Stegomastodon
22	Approximately 875 yds. W. of Calvin Smith's house which is located 8 miles NE. of Crosbyton, near the middle of the Blanco section.....	Hippotigris Nannippus

Class MAMMALIA

Order LAGOMORPHA

Order RODENTIA

Family LEPORIDAE

Family CASTORIDAE

HYPOLAGUS sp.

PROCASTOROIDES sp.

Referred specimen.—Univ. Texas No. 31176-65, a right lower incisor.

Discussion.—The material is insufficient for specific identification. The incisor measures 6 mm. in width. It represents a small or immature individual, or a species somewhat smaller than those already described. Barbour and Schultz (1937) noted a considerable range of size in the Broadwater specimens. This size variation was also observed by Hibbard (1941) in the Rexroad specimens.

Referred specimen.—West Texas Museum No. 437, a superior cheek tooth.

Discussion.—This is the only leporid remains in the Blanco collection. Little can be said of the tooth except that the medial lingual folds are strongly crenulated. The antero-posterior diameter of the tooth measures 2.6 mm. The transverse diameter measures 4.8 mm.

Order CARNIVORA

Family CANIDAE

BOROPHAGUS DIVERSIDENS Cope

Pl. 48, fig. 4

Referred specimens.—Univ. Texas No. 31179-39, a portion of the right maxillary

with the carnassial tooth and the roots of the first molar; No. 31176-64, a right calcaneum.

Discussion.—The carnassial tooth is heavily worn, but it exhibits the characters of the genus in the massiveness of the tooth and in the absence of a parastyle. The antero-posterior diameter of the tooth is 28.3 mm. and the transverse diameter is 13.4 mm.

The calcaneum is slightly larger than the one which Cope referred to *Felis hillanus*. It is considerably larger, however, than the calcaneum of *Osteoborus*. The maximum length measures 55 mm.

VanderHoof (1936) considered Cope's paratypes of *Borophagus diversidens* as forms close to *Canis dirus* and not representing the genus *Borophagus*. He has also suggested that Cope's *Felis hillanus* is not *Borophagus*, but probably *Osteoborus*. There is no material in the present collection referable to *Osteoborus* or *Canis*, and their presence in the Blanco cannot further be substantiated. That *Canis* should appear as part of the Blanco fauna may be expected, but it appears doubtful that the typical middle Pliocene *Osteoborus* actually occurs in the Blanco.

Family FELIDAE

PANTHERA PALAEONCA, n.sp.

Pl. 48, figs. 1, 2; Pl. 49

Holotype.—Univ. Texas No. 31181-192, nearly complete skull and mandible. Skull rather badly crushed.

Referred specimen.—Univ. Texas No. 31176-63, a partial right superior carnassial tooth.

Locality and horizon.—Blanco beds, Crosby County, Texas. The type is from the head of Blanco Canyon, 10 miles north of Crosbyton, on the J. S. Bridwell ranch, Univ. Texas locality No. 31181, Site No. 11. The material from this site was excavated from the base of the Blanco beds near the contact between them and the underlying Tertiary red sands and clays. The referred specimen is from Univ. Texas locality No. 31176, Site No. 6.

Diagnosis.—A jaguar, differing from the living species *Panthera onca* in having longer carnassials, both absolutely and relatively, and in having longer and more slender superior canines.

Description.—The skull is somewhat damaged. The left zygomatic arch is incomplete, and the sagittal and occipital crests are missing. Some of the incisors are damaged, and the protocone of the right carnassial is absent. Parts missing on one side of the skull are usually present on the other so that a fairly accurate picture of the skull may be obtained.

The dorsal outline of the skull is convex with the highest portion apparently over the orbits. The checked and broken bones of the skull do not permit, for the most part, a discussion of the elements in relation to each other, or a detailed comparison with the bones of other species.

The mandible lacks the posterior region of the left side and the tip of the coronoid process of the right side. The incisors, canine, and posterior portion of the carnassial of the left side are missing. The second and third premolars are also missing, but these were probably lost during the life of the animal because the alveoli are completely filled with bone and the surface is roughened and pitted. The alveolus for the left canine appears too small to have housed the tooth, and it also was probably lost before the death of the animal.

Except for the teeth, there appear to be no significant differences in the construction of either the skull or the mandible beyond what easily falls within the range of individual variation of *Panthera onca*.

Discussion.—Merriam and Stock (1932) have shown that there is a great variation in size among the jaguars. The measurements of the skull and jaw of the Blanco specimen indicate a cat of about average jaguar size. The superior and inferior carnassials, however, exceed in length those of the recent jaguar.

Ratio diagrams were made using six characters measurable on the fossil and living species. For these comparisons eight specimens of the modern puma were used, five specimens of the modern jaguar, four specimens of the modern lion, and three specimens of the modern tiger. These results are shown in figure 4.

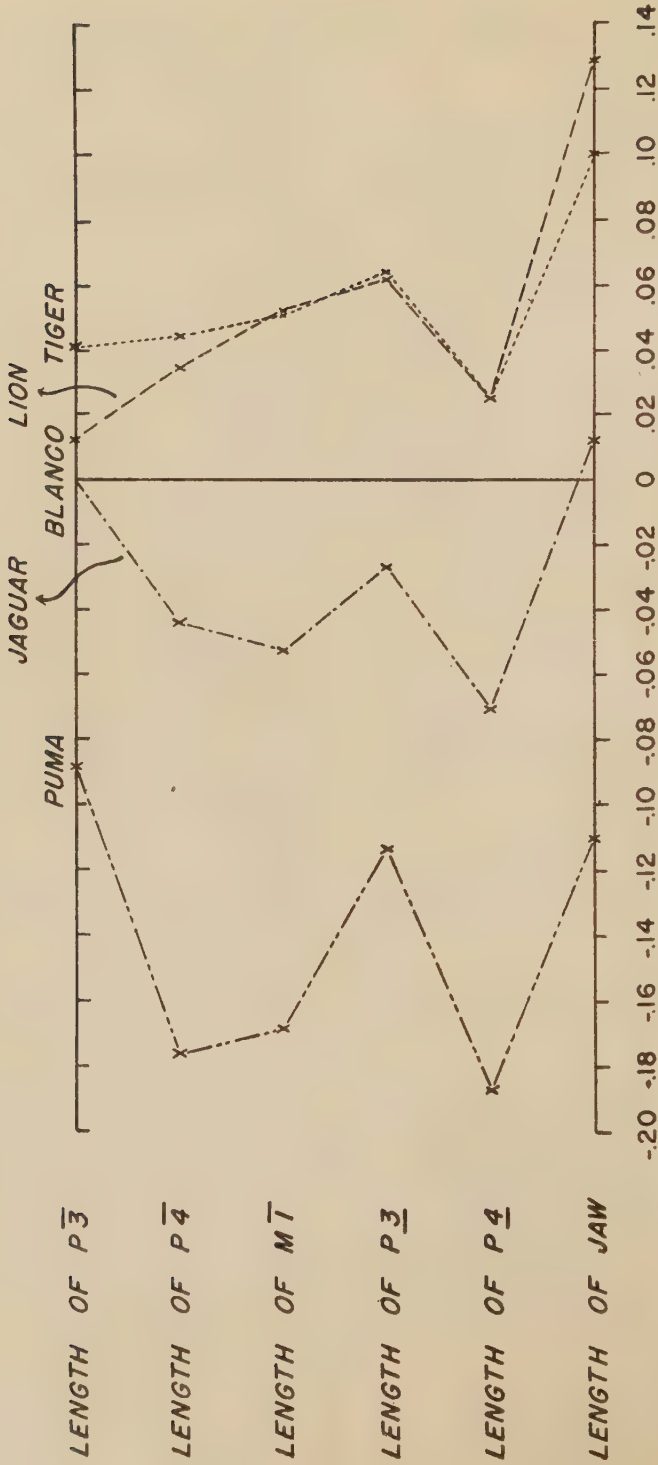


Fig. 4. Ratio diagram of mean values in skull and jaw dimensions in several specimens each of the puma, jaguar, lion, and tiger. In the diagram, Blanco refers to the Blanco specimen *Panthera palaeonca*.

The proportions of P/4, M/1, and P4/ to the length of the jaw, compared to *Panthera onca*, are significantly different as analyzed statistically. The differences are shown in the following table:

Variate	<i>Panthera onca</i> N = 6		d of <i>Panthera palaeonca</i> from <i>Panthera onca</i> mean	d/ σ'
	Mean	σ'		
P/4				
Length of jaw.....	12.3	.38	1.8	4.73
M/1				
Length of jaw.....	12.5	.76	2.6	3.42
P 4/				
Length of jaw.....	17.1	1.10	4.3	3.91

Order PROBOSCIDEA

Family SERRIDENTIDAE

RHYNCHOTHERIUM FALCONERI Osborn

Referred specimens.—Univ. Texas Nos. 31177-1 and 31177-23; each a third molar.

Discussion.—These teeth seem clearly referable to *Rhynchotherium falconeri*. They differ from the type mainly in the better developed fifth ridge, which consists of three cones instead of two as in the type specimen.

Included in the collection are three other molar teeth which can only doubtfully be referred to this genus, but certainly not to this species. Each represents a third molar. The ridges resemble those of *Rhynchotherium* in that they are more wedge-shaped than the ridges of *Stegomastodon*, which give a general appearance of rounded cones. Each tooth consists of five ridges, the last, however, being rudimentary as in *Rhynchotherium*. They are reminiscent of *Stegomastodon* in that the valleys between the ridges are filled with accessory cones, although they are not as numerous as in most specimens of *Stegomastodon*. Undoubtedly more complete material will clear up the relationships of these doubtful teeth.

Family HUMBOLTIDAE

STEGOMASTODON SUCCESSOR Cope

Pl. 50, figs. 1-4

Referred specimens.—Several partial skulls and mandibles and about forty isolated teeth.

Discussion.—Three species of *Stegomastodon* are listed from the Blanco: *S. successor*, *S. texanus*, and *S. mirificus*.

M/3 of *S. successor* is described as having five complete ridge-crests, the pentalophid consisting of two half-cones without trefoils and the hexalophid consisting of two primitive conelets. The type jaw

of *S. successor* does not have a completely erupted M/3, and all the other material from the Blanco referred to this species by Osborn consisted of immature individuals. The teeth of these individuals might have presented quite a different appearance if they had been fully adult. The teeth in the present collection clearly demonstrate that the posterior ridges and cones not only become progressively larger with advancing age of the individual, but that posterior accessory conelets and cones are added as well, during and after eruption of the tooth.

In the collections of the West Texas Museum there is a complete mandible, No. 392, and a maxillary containing a complete M 2-3/ of *Stegomastodon successor*. These were collected several years ago by Dr. M. A. Stainbrook. There can be no doubt that these belong to the same individual because the mandible was found with the teeth up, and the maxillary with the teeth down, directly over the jaw. Remains of the skull and the tusks were found in place but were so badly weathered that it was impracticable to collect them. In these specimens the first three ridge-crests show wear, a stage of wear beyond that of the type jaw. Accordingly the hexalophid is considerably more developed than in the type. It consists of two cones almost as large as the cones of the pentalophid, but not quite so high. There is no evidence of accessory cones posterior to the pentalophid, but the posterior part of the tooth is still buried in the jaw, so this cannot definitely be determined.

In M 3/ the hexaloph is composed of two prominent cones, widely spaced and with two small inconspicuous cones or

conelets between. The heptaloph is composed of four low, inconspicuous conelets almost in a transverse row.

Osborn has not referred any superior teeth to *S. successor* but assumed that the ridge-crest formula for M 3/ of this species was 5½ because (1936, p. 682): "the inferior molars of *Stegomastodon* are much more progressive than the superior molars. . . ." Therefore, since the ridge-crest formula of M/3 is +,5½, the formula of the superior M 3/ could not have been more than that of the inferior molar. His belief that the inferior molars possessed from a fraction to one more ridge-crest than the superior molars is not borne out by the evidence of the associated superior and inferior molars of specimen No. 392, nor is it substantiated in the case of the superior and inferior teeth of *S. primitivus*. The ridge-crest formula for M 3/ of *S. successor*, as shown by No. 392 and other specimens, should be at least 6½ instead of 5½. It is also somewhat misleading in the case of M/3, to consider it a + 5½ crested tooth. The first fractional ridge-crest, the plus ridge-crest, is the pro-protolophid. This occurs on all unworn teeth, but it completely disappears because of attrition with the posterior end of M/2 as the tooth is progressively worn and moved forward in the jaw. There should at least be consistency in giving this fractional ridge-crest credit for being present in all teeth, or not consider it at all.

The characters of the hexaloph and heptaloph of M 3/ of several specimens of *Stegomastodon successor* are summarized in the following table:

M 3/ of *Stegomastodon texanus* consists of a low rudimentary sixth crest consisting of from four to five conelets and a rudiment of the heptaloph. The above table demonstrates that in a series of only six specimens the hexaloph may vary from four to two cones, all having a rudiment of the heptaloph. In fact, No. 31171-25 may be considered to have a rudimentary octaloph. The mandible, No. 392, is 5½ crested and should be referred to *S. successor*. The maxillary, in which M 3/ is 6½ crested, however, belongs to the same individual. Osborn gives the ridge-crest formula of *S. texanus* as M 3/ 5½-6. All the specimens listed in the above table are specifically indistinct from No. 392. The differences are due to individual variation.

Apparently Osborn estimated the ridge-crest formula for M 3/ of *S. successor* to be 5½ on the basis of the ridge-crests of his other species. He does not refer any superior molars to this species. The large number of teeth in the present collection preclude the probability that the superior molars of *S. successor* are not included in the collection.

M/3 of the type jaw of *S. texanus* consists of a heptalophid of three cones and an octalophid of two cones. M/3 of the paratype jaws of *S. texanus* consists of a hexalophid of two prominent cones and a depressed heptalophid.

No. 31178-8, an M/3, possesses a hexalophid of two cones, with an intermediate anterior cone, and a depressed heptalophid of two cones. No. 31171-19, an M/3, possesses a hexalophid of two cones and a heptalophid of two double cones.

M 3/ No.	Hexaloph	Heptaloph
392	Four cones. (Two prominent cones; two intermediate conelets.)	Four low conelets.
31171-8	Right molar: Three cones. (Two prominent cones, one anterior intermediate conelet.) Left molar: Four cones. (Two prominent cones, one anterior and one posterior intermediate conelet.)	Right molar: No distinct conelets. Left molar: Four low conelets.
31171-25	Three cones. (Two prominent cones; one prominent median cone between pentaloph and hexaloph.)	Six conelets. (Arranged in two transverse ridges of three conelets each.)
31171-27	Two cones.	Four conelets. (Two prominent conelets, one low intermediate conelet and one posterior conelet.)
31198-1	Two cones.	Two appressed cones.
31178-19	Two cones.	Three conelets. (Two prominent conelets; one small median posterior conelet.)

No. 31171-13, an M/3 has a hexalophid of three cones and a heptalophid of three low cones.

Osborn considered *S. texanus* to occur in the middle and upper levels of the Blanco; *S. successor* to occur in the lower levels. This vertical distribution is not borne out by the present collection. Specimens ordinarily referable to *S. texanus* and *S. successor* occur at any level in the Blanco. No. 392, for instance, occurs well toward the top of the Blanco; the lower teeth are referable to *S. successor* and the superior teeth referable to *S. texanus*. One can only draw the conclusion that *S. texanus* and *S. successor* are not distinct species but only individual variants of one species.

It is not possible at the present time, nor advisable without first-hand information to be gained by a comparison of the actual specimens, to draw any definite conclusions regarding the other species of *Stegomastodon*. However, by reference to the descriptions and figures certain facts become obvious.

Osborn depended greatly on the number of ridge-crests to arrange the species of *Stegomastodon* in an orderly ascending sequence. He considered the Aftonian species *S. primitivus* to be the most primitive of the series. On the basis of M/3 it appears to be as advanced, if not more so, than some of the more simplified individuals from the Blanco. It matters little, however, whether it is more primitive than the Blanco species or not; but if it is, there certainly remains no justification for believing that the geologic age of *S. primitivus* demands further investigation. It seems fairly well established that its age is Aftonian. It is far more logical to reconsider the age of the Blanco.

S. mirificus seems clearly to fall within the range of variation displayed by the Blanco specimens.

In the type jaw of *S. texanus* there is a heptalophid of three cones and an octalophid consisting of two cones. The ridge-crest formula is given as $6\frac{1}{2} +$. The heptalophid and octalophid are fully as well developed as in M/3 of *S. arizonae* in which the ridge-crest formula is given as $7\frac{1}{2}$. The writer suspects that further study will reveal no specific difference be-

tween the Curtis and the Blanco *stegomastodons*.

The most progressive species, *S. aftoniae*, with a ridge-crest formula of $7\frac{1}{2}$ can be matched with specimen No. 31171-25 from the Blanco, in which the last ridge is composed of 3 conelets and may be considered a rudimentary octaloph.

It is to be expected that *Stegomastodon* should have a great amount of individual variation. There is a basic pattern of ridge-crests in the molars of the genus. These ridge-crests are buttressed by numerous cones and conelets of varying numbers and complexities. Buttressing cones developing at the posterior margin of the tooth apparently varied greatly, in some individuals growing into larger cones and forming a ridge-crest, in others remaining as numerous small conelets on the talon or talonid. This tooth variation is well demonstrated in the Blanco specimens which show gradations from the simplest to the most progressive of the named species. This indicates that all the species of *Stegomastodon* may be variants of a single species. Certainly there is no indication of more than one species of *Stegomastodon* in the Blanco. This is *S. successor*, inasmuch as it was named prior to *S. texanus*.

Order EDENTATA

Family MEGATHERIIDAE

MEGALONYX LEPTOSTOMUS Cope

Pl. 55, figs. 5, 6

Referred specimens.—Univ. Texas No. 31175-19, anterior portion of right ramus with three teeth; No. 31196-5, eight isolated teeth; West Texas Museum No. 438, anterior portion of a mandible lacking the teeth.

Discussion.—The type of *Megalonyx leptostomus* consists of some skull fragments and a superior tooth. Matthew (1924b) reported the discovery of some jaw fragments and teeth from the Blanco. The present material, while also fragmentary, is unquestionably referable to the same species.

The jaw is deep and, in the region of the cheek-teeth, quite thick. A keel is developed on the upper part of the anterior end of the symphyseal region. It flares

widely at the upper extremity and is three-lobed. A large mental foramen is located on each side between the keel and the anterior tooth. A deep sulcus lies on the outer face of the jaw between the caniniform tooth and the first cheek tooth. This sulcus, however, is not nearly so deep as in *Megalonyx jeffersoni californicus*. It extends lingually only slightly beyond the outer margin of the first cheek tooth. Accordingly, the width of the jaw between the caniniform tooth and the first cheek tooth is considerably wider than in *M. jeffersoni californicus*.

The caniniform tooth is essentially like that of *M. jeffersoni*. The outer face is convex, the inner face convex in the posterior portion with a concavity in the anterior third of the tooth. The first cheek tooth is separated from the caniniform tooth by a diastema. The anterior face is slightly concave, the posterior face slightly convex, and wider transversely than the anterior face. The first and second cheek teeth are widest antero-posteriorly on the outer side. The second cheek tooth narrows toward the inner side as in *M. jeffersoni californicus*.

characters which distinguish them from the plates of the type specimen of this species.

Order PERISSODACTYLA

Family EQUIDAE

HIPPOTIGRIS SIMPLICIDENS (Cope)

Referred specimens.—Univ. Texas No. 31176–58, right maxillary; No. 31216–1, left maxillary; No. 31179–29, partial left jaw; a number of isolated superior and inferior cheek teeth and numerous limb bones.

Discussion.—The superior cheek teeth are large, high crowned, and with a moderate curvature. The parastyle and mesostyle are well developed. The protocone is elongate, grooved ventrally, and with a large heel on the anterior portion. The medial sides of the enamel lakes have a few folds, variable in number and in size; the lateral sides usually have one distinct fold, which becomes inconspicuous or absent in well-worn teeth.

In the lower teeth the metaconid and metastylid are separated by a distinct groove to the base of the tooth. In un-

Measurements of *Megalonyx leptostomus*

	No. 31175–19	No. 438*
Greatest length of symphysis.....	80.0	
Diastema between anterior tooth and first cheek-tooth.....	24.4	
Anterior tooth, greatest antero-posterior diameter.....	30.0	29.5
greatest transverse diameter.....	14.5	13.2
First cheek-tooth, greatest antero-posterior diameter.....	16.5	16.0
greatest transverse diameter.....	23.0	20.0
Second cheek-tooth, greatest antero-posterior diameter.....	16.0	15.0
greatest transverse diameter.....	23.0	22.6

*Tooth measurements made on alveoli.

Family GLYPTODONTIDAE

GLYPTOTHERIUM TEXANUM Osborn

Pl. 48, fig. 3

Referred specimens.—Univ. Texas No. 31194–3, ten osseous plates; No. 31193–7, an osseous plate; West Texas Museum No. 439, five osseous plates.

Discussion.—The plates possess a relatively large central area surrounded by nine to ten peripheral plates of much smaller size which are irregularly pentagonal or hexagonal in shape. There is a wide range of variation within the plates of an individual glyptodon, but these possess no

worn teeth the groove is rather narrow and V-shaped, but in teeth showing extreme wear the groove becomes widely U-shaped. This tendency is also noticeable on unworn teeth as shown by the broadening of the metaconid-metastylid groove as it approaches the base of the tooth. With teeth in the same stage of wear the metaconid-metastylid groove is more angular than in the specimens of *Equus* that were examined. The metaconid and metastylid are quite round in unworn teeth, but become progressively more angular with wear, particularly the metastylid.

These characters definitely place the large Blanco equids in the *Hippotigris* group and serve to confirm McGrew's (1944) observations on the distinctions between this group and the true *Equus* of the later Pleistocene of North America.

Hibbard (1938) suggested that *Plesipus cumminsii* represents heavily worn teeth of smaller individuals of *P. simplicidens*. The present material from the Blanco contains a few well-worn teeth which approach the appearance of Cope's *P. cumminsii*. The writer can see no justifiable reason for specifically separating them from the larger teeth. It seems best to relegate this questionable species to a synonym of *Hippotigris simplicidens*.

NANNIPPUS PHLEGON (Hay)

Referred specimens.—Univ. Texas No. 31216-7, a right superior cheek tooth; No. 31216-15, a left inferior cheek tooth; West Texas Museum No. 440, a partial right ramus with P/2-4—M/1.

Discussion.—The remains of *Nannippus* are not nearly as abundant as are those of *Hippotigris*. Blancan time represents the latest reported occurrence of this small genus. McGrew (1944) has indicated that the geographic range of *Nannippus* was already restricted by Blancan time as shown by its absence in equivalent deposits of the west and in Sand Draw. Inasmuch as *Nannippus* and *Hippotigris* are contemporary genera, living under the same environmental conditions, one should expect to find their remains about equally well represented in the Blanco if they had been of comparable numbers during Blancan time. The paucity of *Nannippus* material in the Blanco is undoubtedly attributable to the diminishing number of individuals prefacing their final extinction.

The Blanco material does not add to the knowledge of this species.

Order ARTIODACTYLA

Family TAGASSUIDAE

PLATYGONUS BICALCARATUS Cope

Pl. 51, figs. 4-6; Pl. 52, figs. 1, 2

Referred specimens.—Univ. Texas No. 31175-12, anterior portion of a skull with right canine, and complete premolar-molar series, except for damaged portions of the right M 1-2/; No. 31179-55, left M/1; No. 31193-8, left P 2/; No.

31178-30, right P 2/; No. 31176-10, right DM/4—M/1; No. 31176-22, fragmentary left mandibular ramus with DM/4M/1. The last two specimens are from the same site, agree in size, and in the stage of wear of the teeth, and perhaps belong to the same individual.

Discussion.—No. 31175-12, a partial skull, is too incomplete for descriptive purposes, except for the teeth. The canine is large, elliptical in cross section, and with the anterior face well worn by the lower canine.

There is a considerable variation in the structure of the premolars. There is also a great difference in the amount of wear, the left premolars being fairly well worn, while the right show but slight signs of wear. The specimen agrees in essential details and in size with the palate of *P. bicalcaratus* described by Gidley (1903a).⁵

Gidley (1903a) lists the chief distinguishing characters of *Platygonus bicalcaratus* as follows: "(1) The posterior and anterior crests of the molars are high and completely divided by the cross valley. (2) The cones forming the crests are comparatively wide apart at their summits; thus when they become a little worn the upper molars of this species present very much the appearance of the lower molars of the tapir. (3) The posterior heel in M3/ is entirely wanting."

The present material may be too inadequate to permit definite confirmation of all these differences. However, on the basis of the additional specimens from the Blanco the writer is able to make the following observations:

Valid characters.—Size slightly smaller than *P. texanus*; absence of a posterior heel on M3/; posterior cingulum on superior molars not distinctly separated from the posterior oblique ridge; anterior and posterior lophs of inferior molars relatively lower than in *P. texanus*; and posterior cingulum of M/1-2 forming a more conspicuous cusp than in *P. texanus*.

Doubtfully valid characters.—The anterior and posterior crests of the superior molars are not completely divided by the cross valley as in the specimen described by Gidley. No. 31176-61,

⁵A cast of *Platygonus bicalcaratus* (Amer. Mus. No. 10701) was made available by Dr. E. H. Colbert for comparisons.

referred to *P. texanus* because of its larger size, and the shelf-like appearance of the posterior cingula on M 1-2/, have the lophs completely divided by the cross valley. It appears that this feature may be present in either species. The material does not permit definite determination of the reliability of this character. Also it cannot be demonstrated that the crests of the lophs are any wider apart at their summit in *P. bicalcaratus* than in *P. texanus*.

Two of the features listed as valid deserve a more complete description. These are observed in the character of the posterior cingula. In the superior molars there is a conspicuous ridge on the posterior portion of the tooth which extends obliquely from the apex of the postero-internal cusp to the middle of the posterior cingulum. The ridge merges so completely with the cingulum that there is no line of demarcation between the two. The ridge and cingulum are more prominent on M 3/ and become progressively less prominent on M 2/ and M 1/. These same characters are present in *P. texanus*, but the oblique ridge is distinctly separated from the posterior cingulum; the latter extends around the base of the tooth as a prominent shelf.

In the inferior molars there is a similar ridge which extends obliquely from the apex of the postero-external cusp to merge with the posterior cingulum in its mid-portion. In *P. bicalcaratus* this forms a conspicuous cusp. In *P. texanus* the cusp is somewhat less well developed.

Gazin (1938) pointed out the inconsistency in size between the type of *P. bicalcaratus* Cope, which consists of a fragmentary tooth, and the palate referred to that species by Gidley. Gazin suggested that the type of *P. bicalcaratus*, considered by Cope to be part of M/3, represents an incomplete P/3 or P/4. The tooth is too small to represent M/3 of any known species of *Platygonus*, and in all probability the type specimen does represent a premolar.

PLATYGNUS TEXANUS Gidley

Pl. 51, figs. 1-3; Pl. 52, figs. 3, 4

Referred specimens.—Univ. Texas No. 31178-13, a right mandibular ramus with P/4-M/3; No. 31176-59, right mandibu-

lar ramus with P/3-M/3; No. 31178-3, right mandibular ramus with canine DM/3-4, part of M/1, and unerupted M/2-3; No. 31175-3, fragmentary left mandibular ramus with P/2-4; No. 31197-2, fragmentary left mandibular ramus with M/2-3; No. 31178-5, left M/1; No. 31193-9, right P 3/; No. 31176-60, fragmentary right ramus with M/1 and erupting M/2; No. 31176-61, right, M 1/ and erupting M 2/. These last two specimens are thought to pertain to the same individual.

Discussion.—The type of *Platygonus texanus* is a palate (No. 10702, Amer. Mus. Coll.) from the Blanco, described by Gidley (1903a). The lower dentition of this species has hitherto remained unknown or unreported.

Lower dentition.—In unworn teeth the transverse lophs are high and separated into two distinct cones at their apex by a longitudinal groove as in other species of *Platygonus*. It may be distinguished from *P. bicalcaratus* by its somewhat greater size, the relatively higher lophs on the molars, and by the presence of a less conspicuous cusp near the base of the posterior portion of the molars. M/3 of *P. bicalcaratus* is not known, but it may be supposed that the posterior heel of this tooth is less well developed than in *P. texanus*, inasmuch as the heel of M 3/ is lacking in the former species. DM/4 of No. 31178-3 is also slightly larger and with relatively higher lophs than the corresponding tooth of *P. bicalcaratus*.

Upper dentition.—The upper molars of *P. texanus* may be distinguished from *P. bicalcaratus* by the somewhat greater size of the former and by the relatively greater height of the anterior and posterior lophs of *P. texanus*. On M 1/ and M 2/, the oblique ridge on the posterior part of the tooth extends from the apex of the postero-internal cusp to the middle of the posterior cingulum. The ridge is distinctly separated from the cingulum, not merging with it as in *P. bicalcaratus*. In addition the cingulum is more prominent, and extends beyond the posterior extension of the ridge as a distinct shelf around the posterior portion of the tooth. M 3/ possesses a distinct and well-developed heel which does not occur in *P. bicalcaratus*.

Measurements, in mm., of *Platygonus*

UPPER DENTITION	<i>P. bicalcaratus</i>		<i>P. texanus</i>	
	No. 31175-12	Amer. Mus. No. 10701	No. 31176-61	Amer. Mus. No. 10702
Canine, greatest antero-posterior diameter.....	25.0			
greatest transverse diameter.....	15.0			
P 2/, greatest antero-posterior diameter.....	Right 11.5 Left 10.6	11.		11.5
greatest transverse diameter.....	12.3 10.5	12.		10.5
P 3 $\frac{1}{2}$, greatest antero-posterior diameter.....	13.4 12.0	12.		13.5
greatest transverse diameter.....	14.6 15.0	13.		12.0
P 4/, greatest antero-posterior diameter.....	11.0 11.4	12.		14.0
greatest transverse diameter.....	15.0 15.5	14.		14.0
M 1/, greatest antero-posterior diameter.....	15.0 16.0	16.5	18.4	17.5
greatest transverse diameter.....	16.4 17.0	15.	16.0	15.5
M 2/, greatest antero-posterior diameter.....	19.4 21.7	19.5	22.2	20.0
greatest transverse diameter.....	20.0 20.0	17.5	20.2	20.0
M 3/, greatest antero-posterior diameter.....	24.3	20.		25.5
greatest transverse diameter.....	20.4	16.		21.5
Length, premolar series.....	34.0			
Length, molar series.....	60.			
Length, premolar-molar series.....	93.0	93.0*		101.

*Measured on cast.

Measurements, in mm., of *Platygonus*

LOWER DENTITION	<i>P. bicalcaratus</i>			<i>P. texanus</i>			
	No. 31176-10	No. 31176-22	No. 31179-55	No. 31178-13	No. 31176-59	No. 31175-3	No. 31179-2
P/2, greatest antero-posterior diameter.....						11.0	
greatest transverse diameter.....						9.0	
P/3, greatest antero-posterior diameter.....					13.7	13.8	
greatest transverse diameter.....					11.3	13.5	
P/4, greatest antero-posterior diameter.....				14.0	15.0	13.6	
greatest transverse diameter.....				13.0	13.2	13.0	
M/1, greatest antero-posterior diameter.....	15.5	15.7	15.0	17.8	16.5		22.0
greatest transverse diameter.....	11.5	11.8	11.7	14.8	13.5		15.0
M/2, greatest antero-posterior diameter.....				21.4	20.4		
greatest transverse diameter.....				17.7	16.6		
M/3, greatest antero-posterior diameter.....				31.0	30.5		30.5
greatest transverse diameter.....				18.6	17.0		16.0
Length, M/1-M/3, inclusive.....				70.0	66.5		
Length, P/2-M/3, inclusive.....				109.0 e	107.0 e		

e, Estimated.

Family CAMELIDAE

GIGANTOCAMELUS SPATULA (Cope)

Pls. 53, 54

Pliauchenia spatula Cope, Geol. Survey Texas, 4th Ann. Rept. (1892), pp. 1-137, 1893.

Gigantocamelus fricki Barbour and Schultz, Univ. Neb. State Mus. Bull., vol. 2, pp. 17-27, 1939.

Referred specimens.—Univ. Texas No. 31181-235, 31181-189, and 31181-237, nearly complete skulls; Nos. 31181-240, 31181-181, 31181-163, and 31181-18, nearly complete rami or mandibles. Also a number of partial skulls and jaws and numerous skeletal parts.

Discussion.—In 1893, Cope described an unusually large camel, *Pliauchenia spatula*, from the Blanco beds. Matthew (1924b) referred additional material secured by the American Museum to the genus *Megatylopus*. Barbour and Schultz (1939) suggested that: "*Pliauchenia spatula* Cope, a species often referred to the genus *Megatylopus*, seems to be much more closely allied to *Gigantocamelus fricki* than to *M. gigas*, the genotypic species of *Megatylopus*." The exact relationships of this large Blanco camel have not been clearly understood. A study of these large Blanco camels shows that they are specifically identical with the large Broadwater camels, and with Cope's original *Pliauchenia spatula*.

Skull.—All of the skulls are somewhat broken and distorted. Therefore, it is necessary to estimate some measurements, but inasmuch as there is considerable individual variation in size among them, a few millimeters of possible error on specimens of this size is not important. No. 31181-189 is one of the best-preserved skulls in the collection. Fortunately the skull is but slightly, if at all, crushed in the dorso-ventral plane. All the other skulls have suffered from being compressed in either the horizontal or the vertical plane, or in both.

Viewed in profile, one of the most striking features is the great height of the muzzle above P 1/. The nasals appear to extend in a plane more nearly parallel to the plane of the palate than in other camels. This appearance, however, may be exaggerated by slight lateral compression suffered in the anterior maxillary

region. In this respect it is more like the typical *Procamelus* skulls which tend to have a noticeably higher muzzle than *Alticamelus* or *Pliauchenia*. The skull is high and long and proportionately of average width between the orbits. The sagittal and occipital crests are broken and damaged in all specimens, but the indications are that both were well developed. The occipital crest is particularly well developed and greatly overhangs the occipital condyles.

The orbit is approximately circular, though the condition of the skulls does not afford definite conclusions. There is no evidence of a supraorbital notch, but its absence may be due to the condition of preservation. There is a large vacuity located just above and anterior to the orbit. The infraorbital foramen is located above P 4/. The condition of preservation has made it impossible to note more than an occasional suture upon the skulls.

The external opening of the nares is widest over the mid-point between the canines and P 1/. The rostrum is greatly constricted between P 1/ and P 3/ and flares anteriorly to its maximum width at the canines. The internal opening of the nares is well shown on No. 31181-235. They are of a compressed U-shape; the anterior end, or lower part of the U, flares slightly. The anterior end of the internal nares opens just posterior to a line drawn transversely through the centers of M 2/.

Upper teeth.—The dental formula of the Blanco specimens is identical with that of the Broadwater specimens described as *Gigantocamelus fricki*. The presence of an occasional third incisor cannot be verified in these specimens because in that area of most specimens the pre-maxillae are either damaged or missing. The canine is a heavy, enlarged tooth, somewhat recurved and with a thin, sharp posterior edge as in the Nebraska specimens. On many of the specimens, the superior canines show a variable amount of wear on the surface caused by the abrasion of the inferior canines.

P 1/ is caniniform, well developed, and recurved, but lacking the sharp posterior edge characteristic of the canines.

P 2/ is absent. P 3/ is well developed and is the most variable of the cheek teeth in structure. The internal crescent is in-

complete in all specimens. In No. 31189-189, it consists of a faint anterior and posterior vertical fold. In No. 31189-235, the posterior fold is but slightly developed, while the anterior fold is heavy and extends obliquely from the crown almost to the middle of the base of the tooth. In no specimens do the folds meet at the base of the tooth, so that in no stage of wear would the internal crescent become complete.

P 4/ is typically camelid, with a complete well-developed internal crescent and fairly well-developed parastyle, mesostyle, and metastyle.

The molars have a heavy parastyle and mesostyle. The metastyle is but slightly developed on M 1-2/ but is prominent on M 3/. The vertical ridge between parastyle and mesostyle is well developed on M 2-3/; the ridge between mesostyle and metastyle much less prominent.

Lower jaw.—The jaw is long, moderately deep, and fairly massive. There is a considerable variation in the symphyseal region of the jaw. In some it is somewhat procumbent, with widely flaring canines. In other jaws the incisors and the canines are almost vertical in position. The symphysis extends back about 25 mm. from the posterior border of P/1. There is a slight flare of the anterior portion of the symphysis. As noted by Cope in his original description of *Pliauchenia spatula*, there is a groove on the inferior face of the symphysis between the median incisors, which extends from the tip of the symphysis posteriorly to the roots of the incisors. On No. 31181-240, this groove is about 35 mm. long and about 5 mm. deep.

The angular process is well developed with a marked inward inflection. The mental foramen lies directly beneath P/1.

Lower dentition.—Of the incisors, Cope (1893, p. 71) states: "The median four incisors stand on a nearly transverse line, while the external ones are sublateral. In their present state of wear the masticating surfaces of the middle pair form very wide ovals, with the longer diameters converging posteriorly. The surfaces of the second incisors are narrower and are acuminate exteriorly, while those of the third are still narrower and more acuminate externally and posteriorly." In

specimen No. 31181-240, this is the condition of the median incisors. The third incisors are missing, but the alveoli are placed in a sublateral position. This same condition prevails in other specimens with but little variation.

The canines are also well described by Cope (1893, p. 71), who states that: "The canines are very robust, and point forward, upward and outward. There is an enamel ridge on the outside of the oblique anterior face, and there is a less prominent ridge on the apical part of the middle line posteriorly. Between these crests the external face is much more convex than the internal one, and the latter exhibits a shallow groove just behind the antero-internal keel." On specimen No. 31181-240 the canines are more heavily worn than in Cope's specimen. The antero-internal face of the canine is beveled from wear from the crown nearly to the base of the tooth. The enamel surface is worn through, exposing the dentine, but at the base of the tooth there is a small remnant of the enamel ridge referred to by Cope. The enamel ridge on the posterior face of the canine has also been worn from crown to base so that here too the dentine is exposed in a narrow strip about 2 mm. wide, extending the full length of the enameled surface. Thus in no place on the posterior face of the canine is the enamel continuous from the inside to the outside portion of the tooth. Toward the base of the tooth there is a shallow groove just behind the antero-internal keel which would undoubtedly be more prominent in less worn teeth. The canines appear to be much larger than in the Broadwater camels referred to this genus.

Most of the inferior canines show a considerable amount of wear on the postero-internal side of the tooth, caused by attrition against the superior canine. However, some specimens show great wear on the antero-internal side of the lower canine. Many also exhibit incisors worn to short stubs.

In connection with the wear upon the posterior portion of the canine there is a unique feature that is not mentioned by either Cope or Barbour and Schultz. This is a depression on each side of the jaw immediately behind the canine. It is elliptical in outline, measuring about 35

mm. along the axis of the jaw and about 30 mm. transversely. It is from 10 to 12 mm. deep. The depression between the canines and P/1 are shown even better in a Hartley County specimen because of the better preservation of the bone. In this specimen the posterior face of the right canine is well worn, and its worn surface is continuous with the anterior portion of the depression. Apparently the superior canines are responsible for the wear on the posterior face of the lower canines, but there seems to be no logical explanation for the broadly open depression immediately posterior to P/1.

P/1 is described by Cope as the fourth premolar. This tooth is compressed transversely, well developed, and is recurved. There is a slight ridge on both the anterior and posterior edges.

P/2 is absent. P/3 is a simple transversely compressed tooth; widest in the middle and narrowing both anteriorly and posteriorly.

P/4 is typically camelid in shape, wide at the posterior end and narrower at the

anterior end, which is inflected inward. In unworn teeth there is an open groove on the posterior border, which with wear becomes an isolated lake on the posterior portion of the crown of the tooth.

The molars appear to present no distinguishing characters. Internal ridges are prominent in unworn teeth but become less conspicuous in moderately worn molars. There is a well-developed vertical valley on the internal side of the molars between the anterior and posterior lobes, and just behind the median vertical style. On specimen No. 31181-181, M/2 and M/3 possess well-developed antero-external vertical styles as in *Tanupolama*. These are present, but less conspicuous, in other specimens. The figures of *Gigantocamelus* from the Broadwater show these same styles to be present.

The third lobe of M/3 is distinctly set off from the posterior lobe by a well-developed vertical groove. It is set in the same plane as the rest of the tooth and is not obliquely set to the long axis of the anterior and posterior lobes of M/3.

Measurements, in mm., of *Gigantocamelus spatula*

SKULL	No. 31181-235	No. 31181-189	No. 31181-237
Maximum length of skull			825
Length, tip premaxillary to condyle	750 e	730 e	750
Length, tip premaxillary to front of P 3/	260 e	285 e	260
Breadth, maximum at orbits	310 e	237 e	320
Length of dental series (C-M 3/, inclusive)	360	370	402
Diastema between C-P 1/	46	56	49
Diastema between P 1/-P 3/	68	81.6	95
Length, P 3/-M 3/, inclusive (at crown)	197	194	194
(at alveolar border)	191	186	192
Length, P 3/-P 4/, inclusive (at crown)	59	60	60
(at alveolar border)	54	52.5	54
Length, M 1/-M 3/, inclusive (at crown)	143	139	137
(at alveolar border)	139	138	140
Height of canine	88	77	84
Antero-posterior diameter of canine at alveolar border	45	42.8	38.5
Width of canine at alveolar border	28	25.4	34
P 1/, greatest antero-posterior diameter	21	19	21
greatest transverse diameter	14	14.4	15
P 3/, greatest antero-posterior diameter	28.6	28	29.3
greatest transverse diameter	17.5	15.5	18.
P 4/, greatest antero-posterior diameter	32.5	31.7	31.
greatest transverse diameter	28.	24.	27.
M 1/, greatest antero-posterior diameter	40.	41.3	37.
greatest transverse diameter	36.5	35.	34.
M 2/, greatest antero-posterior diameter	53.7	54.	49.5
greatest transverse diameter	35.	35.	37.6
M 3/, greatest antero-posterior diameter	59.6	57.	58
greatest transverse diameter	33.	34.	39.

e, Estimated.

Measurements, in mm., of *Gigantocamelus spatula*

MEDIAN PHALANGES		No. 31181-251				
Length	86	80	87	79.5	82.5	
Width proximal end	45	43.5	48	42	47	
Width distal end	42	41	42	39	42	
FEMUR		No. 31179-25				
Maximum length	628					
Greatest width distal end	165					
PATELLAE		No. 31177-3	No. 31181-252	No. 31181-252		
Length	125	115	121			
Width at center	68	62	68			
TIBIA		No. 31195-7				
Maximum length	585					
Greatest width proximal end	166					
Greatest width distal end	120					
ASTRAGALI		No. 31179-44	No. 31179-49	No. 31176-36	No. 31181-191	No. 31181-43
Length	91.5	93.5	86.0	94.0	96.0	
Greatest width	66.5	63.0	63.0	71.0	75.0	
CALCANEI		No. 31175-12	No. 31176-52	No. 31181-73	No. 31181-44	No. 31176-13
Length	158	176	198	202	210	
METATARSALS		No. 31181-157	No. 31181-232	No. 31181-120	No. 31176-20	No. 31181-90
Length (front)	438	405	425	432	402	
Width proximal end	85	88	89	91	88.5	
Width distal end	105	127	120	118	106	
VERTEBRAE						
No. 31181-129, Atlas. Maximum length					170	
No. 31181-68, Axis. Length, odontoid process to posterior edge of centrum					275	
No. 31180-15, Cervical. Length of centrum					168	
No. 31176-21, Lumbar. Length of centrum					102	
Length transverse process					180	

TANUPOLAMA BLANCOENSIS, n.sp.

Pl. 55, figs. 1-4

Holotype.—Univ. Texas No. 31181-126, partial right jaw with P/4-M/3 incl.

Paratypes.—Univ. Texas No. 31176-25, partial mandible with M/1-3; No. 31182-42, partial left jaw with P/4-M/3; No. 31176-5, partial right maxillary with DM 3-4/ and M 1-2/.

Horizon and locality.—Lower Pleistocene, Blanco beds, Crosby County, Texas.

Diagnosis.—Internal side of P/4 more deeply infolded than in *Tanupolama stevensi*. Median, internal vertical folds on M/1-2 more strongly developed than

in either *T. stevensi* or *T. mirifica*, and similar in development to those of *Lama*. Parastyle and mesostyle on M 1-2/ similar to those of *T. mirifica*; more strongly developed than in *T. stevensi*. Anterior lobes of M 1-2/ but slightly wider basally than posterior lobes, in contrast to *T. mirifica*.

Discussion.—The crown of P/3 is not preserved in either of the jaws, but the double roots indicate a greatly reduced and transversely compressed tooth. This tooth is only occasionally present in the McKittrick specimens and is supported by only a single root when present. Additional specimens from the Blanco might

show the absence of this tooth in some individuals, but its double-rooted character in the known jaws from these beds indicates a tooth not quite as reduced as in the California species. The double-rooted character of P/3, however, is not considered a diagnostic character of the Blanco fossils because of the great amount of variability to be found in this tooth in the later Pliocene and Pleistocene camels. P/3 is absent in the type of *Tanupolama americanus* and is represented by a single alveolus in *T. mirifica*.

P/4 is rather deeply infolded on the internal side, similar to that of *Lama*. It is more deeply infolded than in *T. stevensi* and *T. mirifica*. On the crown there is a groove, open posteriorly and extending anteriorly to a point above the middle of the external groove. This open groove would become an isolated lake with additional wear on the tooth.

On M/1 the antero-external styler fold is but faintly developed, while on M/2 and M/3 the styler folds are quite prominent, being comparable to the development shown in *T. stevensi* and *T. mirifica*. The inner face of M/1-2 is more deeply

folded than in *T. stevensi*. The median longitudinal groove is deeper and the vertical style just anterior to it is more strongly developed. The antero-internal style is not as well developed as the antero-external style. The median, internal, vertical style is inconspicuous on M/1. In *T. stevensi*, this style appears to be only fairly well developed and present only on M/2. The internal folds are more prominent than in *T. mirifica* and appear to be nearly equal in development to those of *Lama*.

The posterior lobe of M/3 is distinctly set off from the second lobe on the external side by a deep groove, but on the internal side there is only an inconspicuous groove and ridge to mark the separation. In *Lama* the posterior lobe is distinctly set off from the second lobe also.

No. 31176-5 is a partial maxillary with DM 3-4/ and M 1-2/ present. DM 2/ is represented by a single small root measuring about 2 by 2 mm. Apparently it was ready to be shed, and there is no indication of replacement by a permanent tooth. On the reverse side of the maxillary the roots of the permanent P 3-4/ can

Measurements, in mm., of *Tanupolama blancoensis*

LOWER JAW	No.	
	31181-126	31181-42
P/4, greatest antero-posterior diameter.....	18.0	19.4
greatest transverse diameter.....	8.9	8.7
M/1, greatest antero-posterior diameter.....	26.6	26.2
greatest transverse diameter.....	15.4	15.6
M/2, greatest antero-posterior diameter.....	32.5	30.6
greatest transverse diameter.....	16.8	16.5
M/3, greatest antero-posterior diameter.....	40.0	36.0
greatest transverse diameter.....	15.0	16.0
Length, P/4-M/3, inclusive.....	115.0	113.7
UPPER DENTITION	No.	
	31176-5	
DM 3/, greatest antero-posterior diameter.....	20.3	
greatest transverse diameter.....	14.7	
DM 4/, greatest antero-posterior diameter.....	21.6	
greatest transverse diameter.....	17.5	
M 1/, greatest antero-posterior diameter.....	29.4	
greatest transverse diameter.....	21.0	
M 2/, greatest antero-posterior diameter.....	32.2	
greatest transverse diameter.....	20.0	

be seen. They are well formed and nearly ready to erupt.

DM 3/ is an elongated tooth antero-posteriorly with a small anterior lobe. Its dimensions agree closely with the corresponding tooth of the McKittrick specimen. DM 4/ also agrees closely in size with the McKittrick specimen. It is a molariform tooth, proportionately wider transversely than the molars.

The parastyle and mesostyle of M 1-2/ are more strongly developed than in *T. stevensi* and of about equal development with those of *T. mirifica*. If the molars were reduced by wear to the same stage as exhibited by one of the paratypes of *T. mirifica* (Amer. Mus. No. 23489) they would become shorter and wider and have about the same size and proportions as the latter specimen.

CAMELOPS cf. KANSANUS Leidy

Pl. 55, figs. 7, 8

Referred specimens.—Univ. Texas No. 31181-134 and 31181-14, right rami; Nos. 31199-8, 31181-142, 31181-175, left rami; No. 31181-212, partial mandible. Also a number of skeletal parts.

Discussion.—The *Camelops* material from the Blanco is provisionally referred to *C. kansanus*. The writer does not find it possible to refer these specimens definitely to any of the known species of *Camelops*, and it is possible that they represent a new species. Their true determination must await the discovery of more material, particularly upper dentition, and the more adequate diagnosis of the various species of this genus.

Since *Camelops* has not been previously reported from the Blanco it seems best to give a brief description of the material. No. 31181-212 is an incomplete mandible with complete cheek-tooth dentition. No. 31181-134 is a complete right ramus, lacking the incisors. Nos. 31181-142 and 31181-14 are separate jaws, but both are in the same stage of wear and they agree so closely in size and tooth characters that it is possible they belong to the same individual.

Nos. 31181-42 and 31181-14 represent a young adult with all molars erupted and in use at the time of the death of the individual. There is a small caniniform

Measurements, in mm., of *Camelops* cf. *kansanus*

	LOWER JAW				
	No. 31181-175	No. 31181-142	No. 31181-14	No. 31181-212	No. 31199-8
Diastema between I/3-C	13.5	102.0		91.0	
Diastema between C-P/4	97.3	67.0	74.0		48.0
Diastema between P/1-P/4		26.5			25.0
Diastema between C-P/1		23.6	24.0	27.3	23.7
P/4, greatest antero-posterior diameter	26.3	14.5	15.0	14.3	14.2
P/4, greatest transverse diameter	15.2	33.0	33.0	36.0	31.5
M/1, greatest antero-posterior diameter	24.0	21.0	20.7	24.0	37.0
M/1, greatest transverse diameter	43.8	43.3	43.2	44.0	26.0
M/2, greatest antero-posterior diameter	25.0	21.8	22.5	23.8	53.0
M/2, greatest transverse diameter	56.0	55.3	65.4	58.7	27.0
M/3, greatest antero-posterior diameter	24.4	20.5	20.0	22.0	65.2
M/3, greatest transverse diameter	157.0	155.0	157.0	157.0	24.6
Length, P/4-M/3, inclusive	132.0	132.0	133.0	135.0	181.0
Length, M/1-M/3, inclusive					152.0

P/1 present that does not occur in any of the other specimens. The canine is also less robust than in the other jaws. It is slightly smaller in size, but this is undoubtedly individual variation.

P/4 in all specimens is a triangular tooth, with a marked vertical sulcus on the internal side and a fainter sulcus on the external side. There is a considerable amount of individual variation in the structure of this tooth. In No. 31181-212, the internal groove is deeply infolded, but faintly visible in No. 31178-175, and is intermediate in this respect in the other specimens.

The inner face of the molars is but slightly convex from the base to the crown of the tooth. The face posterior to the internal median style is longer than the anterior face. In No. 31178-175 the inner face of the third lobe of M/3 extends posteriorly in the same plane as the rest of the tooth, so that on the internal side it is scarcely set off from the posterior lobe. In all the other specimens the third lobe of M/3 is distinctly set off from the posterior lobe by being placed obliquely to the long axis of the tooth.

LEPTOTYLOPUS PERCELSUS Matthew⁹

Referred specimens.—Univ. Texas No. 31179-28, a radius-ulna; No. 31179-20,

⁹Rachel H. Nichols has kindly supplied the following information concerning *Leptotylopus* in a letter dated Oc-

a metacarpal; No. 31176-24, a tibia; and several phalanges.

Discussion.—This interesting camel was discovered by the American Museum expedition of 1924. Unfortunately Dr. Matthew did not publish a formal description of this new genus. In his manuscript (1924b) Matthew states: "*Leptotylopus* similarly carries the *Alticamelus* phylum into the '*Pliauchenia* stage' and is decidedly more specialized than *A. procerus* of the lower Pliocene."

The limb bones are too long and slender to be referred to any other genus and judging from Matthew's brief description seem clearly referable to his new genus. If *Leptotylopus* is a descendant of the *Alticamelus* line, as suggested by Matthew, then this genus presents a most interesting parallel to the evolution of *Nannipus*. The skeletal parts of *Leptotylopus* are similar to *Alticamelus* in their great length but differ from the lower Pliocene representatives of that genus in being relatively shorter and more slender.

tober 15, 1943. "Our catalogue card for A. M. 20085 has the name *Leptotylopus percelsus* Type written on it in pencil, in Dr. Matthew's lettering. The data on the catalogue card is given as 'Skeleton, from the Blanco, north side of Crawfish draw, Blanco Canyon, Crosby Co., Texas, collected by Charles Falkenbach in 1924.'"

Measurements, in mm., of *Leptotylopus percelsus*

RADIUS-ULNA		No.			
		31179-28			
Maximum length		775.0			
Width, distal end sigmoid notch		88.0			
Width distal end		96.0			
METACARPAL		No.			
		31179 20			
Length		610.0			
Width proximal end		75.0			
Width distal end		104.0			
TIBIA		No.			
		31193-2			
Length		650.4			
Width distal end		71.0			
PROXIMAL PHALANGES		No.		No.	
		31176-39		31176-35	
Length		142.0	141.0	141.0	121.0
Width proximal end		36.5	36.0	35.0	31.0
Width distal end		30.7	30.0	31.5	25.0
MEDIAN PHALANGES		No.			
		31193-2			
Length		70.0	68.0		
Width proximal end		37.3	37.0		
Width distal end		31.0	30.6		

a, Approximation.

Family ANTILOCARPIDAE

CAPROMERYX sp.

Referred specimens.—Univ. Texas No. 31176-2, partial right M/3; West Texas Museum No. 441, right P 3-4/.

Discussion.—On specimen No. 31176-2, a portion of the third lobe is missing. The anterior and posterior lobes measure 11.5 mm., and the estimated length of the tooth at the crown is from 15 to 16 mm. The transverse diameter is 5.4 mm. The height of the tooth is 21 mm. Specific identification is not possible on the basis of such incomplete material. It records, however, the first occurrence of antilocaprids in the Blanco; a group which undoubtedly was present in large numbers but which has not been found either because of the accidents of preservation or of collecting.

No. 441, a right P 3-4/, shows no characteristics which might distinguish it from other species, or make reference to one of the described species possible.

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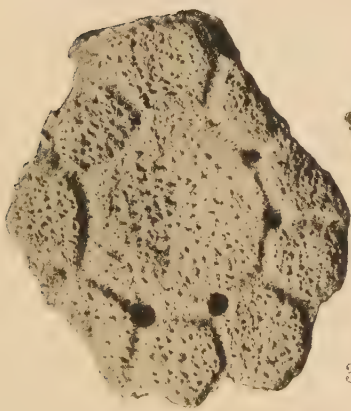
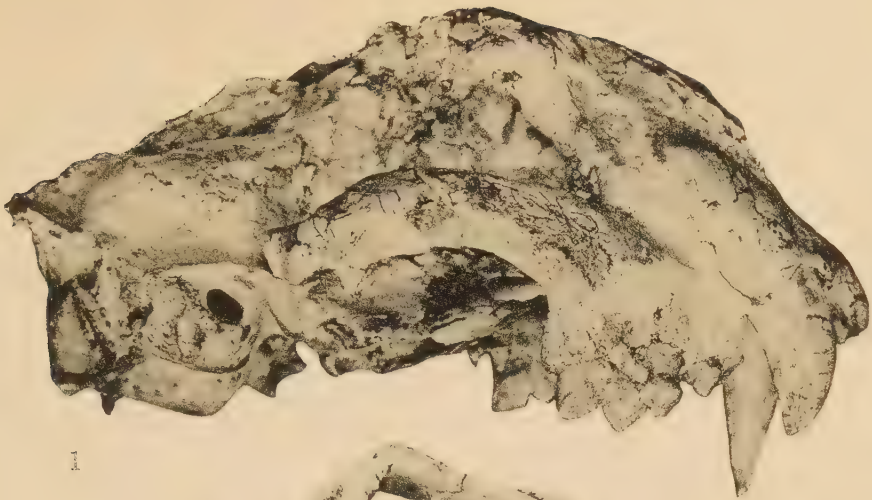


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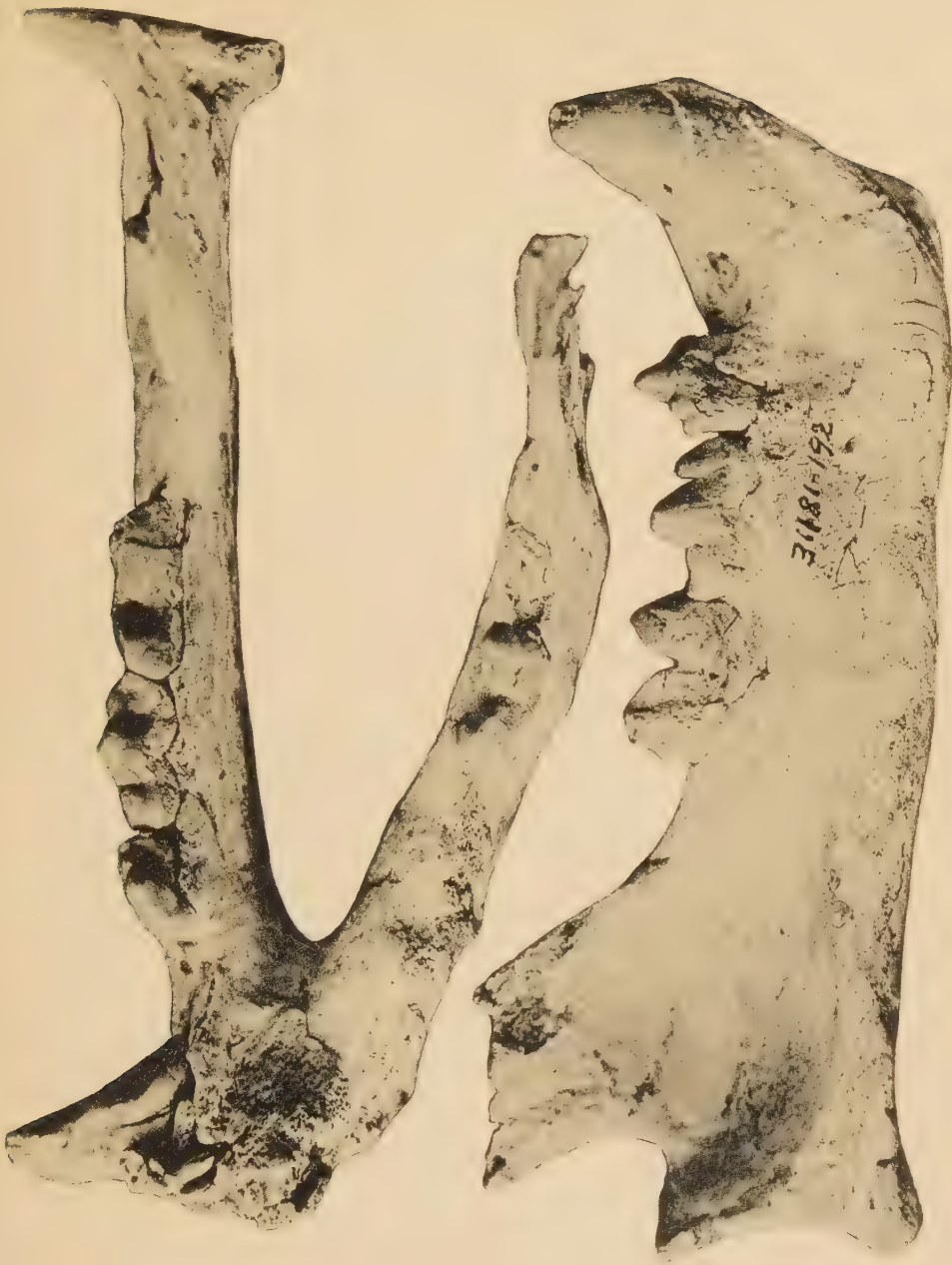
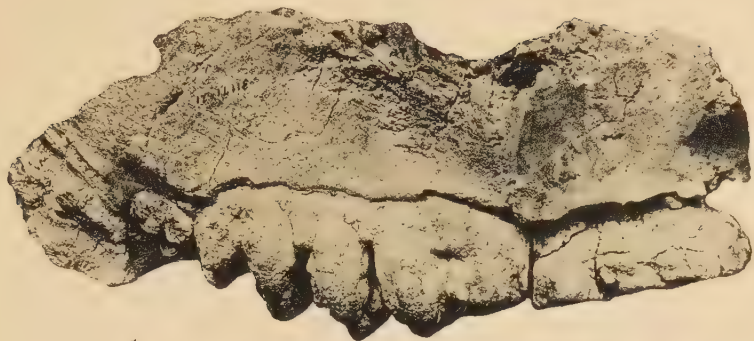


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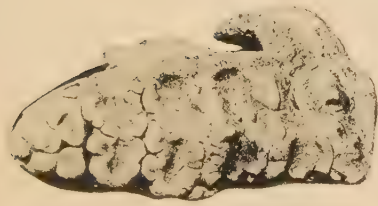
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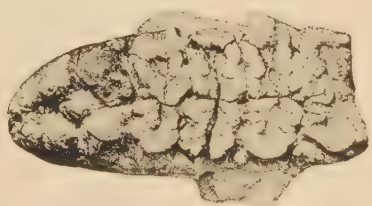
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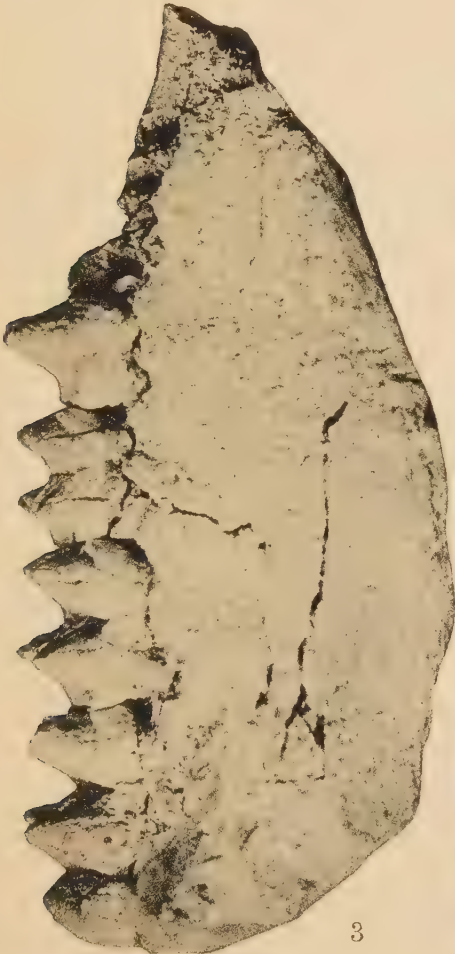


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1



3



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